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Does Managerial Ability Promote Firm Efficiency? An Evidence from Indian Banking Industry

Ram Pratap Sinha[1,*], Bahareh Vaisi[2], Seyyed Ahmad Edalatpanah[3]

[1] Government College of Engineering and Leather Technology, Kolkata-700106, India; rampratapsinha39@gmail.com.
[2] Young Researchers and Elite Club, South Tehran Branch, Islamic Azad University, Tehran, Iran; st_b_vaisi@azad.ac.ir.
[3] Department of Applied Mathematics, Ayandegan Institute of Higher Education, Tonekabon, Iran; s.a.edalatpanah@aihe.ac.ir.

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Abstract

Managerial Ability (MA) plays a key role in the performance of productive firms especially the optimal utilization of firm resources for facilitating revenue generation and growth. However, MA is a factor that cannot be observed directly. The present study provides an indirect estimation of the MA of Indian private-sector commercial banks based on the estimation of residuals from the regression of firm-specific efficiency scores on several contextual variables. The study is based on 126 bank-year observations spread over 7 years. The results indicate that MA is positively and significantly associated with efficiency from 2014 to 2016 and during 2020-2021 for new private banks, and the result is statistically significant. The new private banks have improved efficiency due to low debt overhang (higher performing asset to total asset ratio), better capital adequacy ratio and more command over the market.

Keywords: Banking, Managerial ability, Efficiency, Indian private banks, DEAGP, Panel data regression.

1 | Introduction

The commercial banking sector occupies a special role in the Indian economy as the provider of payments and financial intermediation; nevertheless, up to the 1980s, the Indian financial sector remained heavily dependent on the public sector commercial banks for deposit mobilization and credit disbursement. The pre-emption of banking financial resources through the persuasion of financial repression policy resulted in a scarcity of resources for business and commerce. Moreover, the presence of directed credit allocation to the

Corresponding Author: rampratapsinha39@gmail.com
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priority sector and the absence of prudential regulation of the banking sector led to a progressive deterioration of the banking sector's asset quality, which was not reflected in the books of accounts.

In 1991, India initiated economic liberalization and financial sector reform was assigned immense priority. In 1993 and 2001, the Reserve Bank of India (RBI) announced entry guidelines for Private Sector Commercial Banks (PSCBs) and the branch licensing requirements were abolished. Further, all commercial bank categories were provided greater operational autonomy subject to the adherence to prudential regulations introduced as part of the banking sector reform measures. An important fallout of the reform initiatives was the establishment of several PSCBs, many of which were able to capture significant market share of the banking industry. Overall, there has been a perceptible shift from a regime of directed lending to a regime where banking activities are based on exploiting opportunities provided by the market due to a significant decline in the net interest margin arising from intensifying competition and dismantling interest rate controls.

In the changed circumstances, the importance of Managerial Ability (MA) in facilitating banking sector development has grown significantly. Because of this, the present study seeks to estimate the MA of PSCBs in India from 2014-2015 to 2020-2021. The estimation procedure is based on the procedure advocated by Demerjian et al. [1]. Further, to check the robustness of the results, the study seeks to explore the relationship between profitability performance measures and the estimates of MA. For measuring the MA, we apply a 3-stage procedure that consists of the efficiency estimation using Data Envelopment Analysis-Goal Programming (DEAGP) for commercial banks in the first stage. The logarithm of efficiency on a set of contextual variables is regressed in the second stage, and in the final stage, MA is assessed at regression residuals in line with [1]. An important contribution of this study lies in the first stage as we examine the DEAGP rather than the Data Envelopment Analysis (DEA) method to improve the discrimination power of selecting efficient Decision-Making Units (DMUs). Parsimonious efficiency modeling enables us to evaluate MA in the subsequent stage more rigorously. Secondly, to our knowledge, there is no known published study on the MA of Indian banks. Another contribution of this study is examining the significant association between MA changes from 2014-2015 to 2020-2021 and efficiency changes over the same period.

The paper includes six sections and proceeds as follows. Section 2 provides an overview of the Indian banking sector. Section 3 discusses the related research literature. Section 4 describes the methodology, variables, and data. Section 5 includes the results. Section 6 concludes.

2 | Overview of Indian Banking

Commercial banking occupies a special role in the Indian economy as the provider of payments and financial intermediation up to the early nineties of the preceding millennium. Public sector banks dominated Indian banking since the government promoted mass banking by facilitating the rapid expansion of public sector bank branches in rural and semi-urban areas. Further, no new private sector was being granted permission to commence business. Thus, up to the 1980s, the Indian financial sector remained heavily dependent on the public sector commercial banks for deposit mobilization and credit disbursement. The pre-emption of financial resources of the banking sector through the persuasion of a policy of financial repression resulted in a scarcity of resources for business and commerce. Further, the presence of directed credit allocation to the priority sector and the absence of prudential regulation of the banking sector led to a progressive deterioration of the banking sector's asset quality, which was not reflected in the books of accounts.

As mentioned earlier, the onset of economic reform in India in 1991 led to a structural and policy-related paradigm shift in the banking sector. Based on the recommendations of the Committee on Financial Sector Reform (1991) and the Committee on Banking Sector Reform (1998), the RBI announced entry guidelines for private sector banks in 1993 and 2001, respectively. The deregulation of entry led to several newly established PSCBs many of which were able to capture significant market share of the Indian banking market. This led to the presence of two categories of private sector banks in India: the old private sector banks, which existed before the liberalization of the Indian banking market in 1991, and the new private sector banks, which were established after the onset of banking sector reform in India.

The deregulation of private sector entry and the liberalization of operational norms have promoted banking sector growth in India, particularly in the private sector. *Table A1* in the Appendix provides an overview of the observed growth in the deposits, advances, investments, net worth and Nonperforming Assets (NPAs) of private sector banks operating in India for the period under observation. NPAs imply loans and advances which are not generating income for the banks as the borrowers have defaulted in the payment of principal amount and the interest payable. The table shows that during the observed period, the net NPA of the private commercial banks grew by a compounded annual growth rate of 21.68%, much higher than the growth rates observed concerning deposits, advances and net worth. Net NPAs are arrived at by deducting the quantum of provisions from the gross amount of NPAs.

The banking sector, during operation, has to assume various forms of business risk and credit risk is the most important form of risk. In the Indian context, the credit risk problem resurfaced in the current millennium because of macroeconomic factors. Since 2008-2009, the global economy experienced a slowdown regarding macroeconomic growth and the volume of international trade, adversely impacting the repayment capacity of Indian firms and the asset quality of Indian commercial banks. However, between 2010 and early 2015, RBI followed a policy of asset quality moratorium, which prompted the commercial banks to restructure stressed loans and mask the real situation of asset quality. The Asset Quality Review of RBI in 2015, however, stopped this practice of hiding the true NPA situation as it focused on stressed assets instead of NPA only. Stressed assets are arrived at by adding written-off assets and restructured loans with NPAs. The changes in the asset quality disclosure norm were followed by the passage of the Insolvency and Bankruptcy Code (IBC) in 2016, the bankruptcy law of India, seeking to create a single law for insolvency and bankruptcy.

3| Literature Review

The performance of a productive firm is usually expressed in terms of efficiency which can be thought of as the ratio of observed to benchmark productivity. Given the importance of firm efficiency in long-term survival and growth, the research literature is full of theoretical and empirical studies on productivity and efficiency, and the banking sector is no exception. For a review of international research literature on bank efficiency, the reader is referred to [2]–[7]. Important studies on bank efficiency in the Indian context include, among other things [8]–[13]. Following [1], DEA has been applied by most researchers to measure the efficiency in the banking sector as well. The reader is referred to [14]–[20] for studying some new articles in this field.

Over time, the efficiency literature has shifted from merely estimating efficiency to finding the key drivers. MA is a key efficiency driver which is not directly observable. It implies the capability of corporate managers to deploy resources at the firm's disposal to achieve the desired goals. A modern productive organization operates based on the agency system whereby the owners of a firm engage agents to manage the business on their behalf. The efficacy of the agency system thus depends critically on the manager's ability.

While researchers and industry experts broadly accept the role played by MA in the context of firm performance, there is a wide range of variations regarding the definition of MA across the related research studies. In a study done by [21], MA was considered as the cognitive capability of managers, including physical and mental abilities. Although the economics literature identified the prevalence of the agency system in modern firms, it did not consider the influence of managerial style on their operational outcome [22]. Bertrand and Schoar [23] introduced a new direction in the MA research literature in which the managerial fixed effect factor's influence on various corporate policy variables is considered. This has been accomplished by considering the impact of the switchover of managers from one firm to another during the sample period. Chang et al. [24] studied a sample of CEO departures. They considered three issues: the stock market reaction to such departure, the performance of the CEOs after the switch and the firms' performance after the CEOs' departure. The study exhibited that CEO ability, matters for the concerned organizations. Bamber et al. [25] found empirical evidence that voluntary disclosure policies of organizations are linked to managerial characteristics. Dyreng et al. [26] found that the influence of individual executives on tax avoidance by corporates is significant. The aforementioned literature had an important limitation. Estimating the

managerial fixed effect requires information on the movement of CEOs across firms. Thus, the database comprises only firms where a CEO switch occurred. In this context, Demerjian et al. [1] introduced a three-stage approach for estimating MA, which is not dependent on such CEO movements. They argued that while MA is an important determinant of firm performance, it is not directly observable. For isolating the impact of an unobservable factor like MA, it is essential to eliminate the influence of other variables on firm efficiency. This is achieved through a multi-stage approach in which efficiency is estimated in the first stage through the application of DEA. In the second stage, estimated efficiency scores are regressed on other influential contextual variables. An estimate of MA is then obtained as the residual of the regression estimate. Since the residual measure might contain other variables not included in the list of contextual variables, validation is done in the final stage by exploring the relationship of other well-accepted profitability measures with the MA measure. Several research studies followed and extended the methodology of [1] in various directions. Demerjian et al. [27] explored the relationship between corporate earnings quality and MA. The study found empirical evidence that MA positively influences organizations' earnings quality, improving earnings level and persistence. Demerjian et al. [28] studied if a better MA facilitates stability in earnings management. The study strongly indicates that MA positively influences the smoothing of firm earnings and future operational performance. Baik et al. [29] found that MA influences income smoothing. Oskouei and Sureshjani [30] studied the relationship between real earnings management and MA in the context of economic and financial crises and found that managers with higher ability provide less attention to the management of real earnings of the firm. Banker et al. [31] evaluated MA for the US property–liability insurance sector for 2005-2015 and showed that MA is strongly and positively related to managerial fixed effects and Return On Assets (ROA). Ting et al. [32] found that firm capital structure mediates the relationship between MA and firm performance. Specifically, it was observed that firms with higher levels of MA have lower debt. Abdesslem et al. [33] considered the influence of credit and liquidity risks and the moderating role played by MA on the likelihood of European banks' default in 2016 and 2017. They found that while higher credit and liquidity risk increase the default likelihood, this is not weakened by the presence of higher MA.

Several other researchers have measured MA, and the reader is referred to some of the new extant studies, such as [34]-[44].

In the Indian context, there is no published research on the MA of Indian commercial banks. The present study seeks to fill this gap. The broad objective of the study is to evaluate the efficiency and MA of Indian private sector banks in the post-global crisis phase and consider the impact of MA on their profitability. Specifically, the study examines the validity of the following research hypothesis:

I. H_1: there is no difference in the efficiency performance between the old and new PSCBs.

II. H_2: old and new private sector banks do not exhibit any difference concerning MA.

III. H_3: the profitability and MA relationship does not vary across old and new private sector banks.

4 | Materials and Methods

In this section, the first DEAGP method is used to estimate the efficiency of the in-sample commercial banks. Then, contextual variables' effect on banks' performance is eliminated for getting a residual based measure of MA, and at last, the constructed measure is used as an independent/dependent variable. The details of the above-mentioned structure, DEAGP modeling, MA estimation, and their properties are discussed in this section.

4.1 | Estimation of Efficiency

DEA has been considered one of the most well-known mathematical methods for measuring the relative efficiency of similar DMUs. DEA technique has several advantages, including its ability to calculate efficiency with multiple inputs and outputs without specifying a parametric relationship between them. The initial DEA

framework provided by [45], estimated efficiency in the context of constant returns to scale, which was later extended to the variable returns to scale scenario by Banker et al. [46] and called the Banker, Charnes and Cooper (BCC) model. Both approaches framed their efficiency model for n DMUs with m inputs and s outputs as the ratio of a weighted sum of outputs to a weighted sum of inputs. The efficiency of the unit is a fractional linear program, as shown in *Eq. (1)*, where (v, u) is the set of weights to be applied to the inputs (x) and outputs (y), and W is a free variable.

$$\max E_0 = \frac{\sum_{r=1}^{s} u_r y_{r0} + W}{\sum_{i=1}^{m} v_i x_{i0}},$$

Subject to

$$\frac{\sum_{r=1}^{s} u_r y_{rj} + W}{\sum_{i=1}^{m} v_i x_{ij}} \leq 1, j = 1,2, \ldots\ldots, n, \text{ W; free variable,} \quad (1)$$

$$u_r \geq 0, \quad r = 1,2, \ldots\ldots, s,$$

$$v_i \geq 0, \quad i = 1,2, \ldots\ldots, m.$$

However, a major weakness of the DEA framework is that the optimal weight is zero for many of the firms included in the reference set used for benchmarking. This greatly diminishes the discriminatory power of the DEA. Given this, the DEA measure could be combined with Multi Criteria Decision Making (MCDM) techniques to apply a Common Set of Weights (CSWs) for the inputs and outputs. This could help decision makers to have a common base for their classification. The reader is referred to [47]–[55] for studying some previous research on the combination of DEA and MCDM techniques.

The formulation of the BCC model as a multi objective fractional linear programming model with the same objective function and constraints and to maximize the efficiency of all the j number of DMUs is denoted in *Eq. (2)*.

$$\max \left\{ \frac{\sum_{r=1}^{s} u_r y_{r\,1} + W}{\sum_{i=1}^{m} v_i x_{i\,1}}, \ldots, \frac{\sum_{r=1}^{s} u_r y_{r\,j} + W}{\sum_{i=1}^{m} v_i x_{i\,j}} \right\},$$

Subject to

$$\frac{\sum_{r=1}^{s} u_r y_{r\,j} + W}{\sum_{i=1}^{m} v_i x_{i\,j}} \leq 1, \quad j = 1,2, \ldots\ldots, n, \text{ W; free variable,} \quad (2)$$

$$u_r \geq 0, \quad r = 1,2, \ldots\ldots, s,$$

$$v_i \geq 0, \quad i = 1,2, \ldots\ldots, m.$$

In *Eq. (2)*, there are n DMUs, $DMU_j (j = 1, \ldots, n)$, where each DMU uses inputs $x_{ij} (i = 1, \ldots, m, j = 1, \ldots, n)$ and produces outputs $y_{rj} (r = 1, \ldots, s, j = 1, \ldots, n)$.

To combine the BCC model with Goal Programming as an MCDM technique for measuring the efficiency of the private banks as the DMUs of the current study, *Eq. (3)* expresses the combined model.

$$\min \sum_{j=1}^{n} {d_j}^+ + {d_j}^-,$$

Subject to

$$Z_j - g_j = {d_j}^+ - {d_j}^-, \quad j = 1,2, \ldots\ldots, n, \quad (3)$$

$${d_j}^+, {d_j}^- \geq 0.$$

The goal Programming technique uses the concept of minimizing deviations from the goal $({d_j}^+, {d_j}^-)$ in decision making. Based on this technique, by assuming that the goal for the objective function j, (Z_j), is g_j,

then the multi-criteria problem (*Model (2)*) is converted to a single-criteria problem (*Model (3)*). Based on the aforementioned, DEAGP is formulated as follows:

$$\min \sum_{j=1}^{n} d_j^{+} + d_j^{-},$$

Subject to

$$\frac{\sum_{r=1}^{s} u_r y_{rj} + W}{\sum_{i=1}^{m} v_i x_{ij}} + d_j^{-} - d_j^{+} = 1, \quad j = 1,2,\ldots..,n, \tag{4}$$

$$u_r \geq 0, \quad r = 1,2,\ldots..,s,$$

$$v_i \geq 0, \quad i = 1,2,\ldots..,m,$$

$$d_j^{+}, d_j^{-} \geq 0, \qquad j = 1,\ldots,n.$$

where all the goals equal 1 (the maximum amount of efficiency).

In the first stage, we will employ the DEAGP model to estimate the efficiency measures of Indian banks using *Model (4)*. Based on this model, u_r^* and $v_i^*$are achievable as the CSWs, and the efficiency of the banks could be calculated considering them. It should be noted that both firm characteristics and management characteristics influence this efficiency score.

4.2 | Estimation and Validation of MA

The estimated efficiency scores using DEAGP are dependent on several contextual variables. These contextual variables do not directly enter into the production process. However, they influence the usage of inputs, and some indirectly affect the outputs. Thus, it is essential to explore the relationship between the efficiency scores and the contextual (explanatory) variables to explain the efficiency scenario. We have several options for estimation: Tobit regression, pooled Ordinary Least Squares (OLS), fixed effects model and random effects model. In the case of Tobit regression, the efficiency scores are directly regressed on the contextual variables. In the case of DEAGP, the efficiency scores are bounded from below. However, the efficiency scores are not generated from data censoring. Thus, McDonald [56] suggested that second-stage regression should be carried out by expressing the dependent variable in fractional data.

We must transform the dependent variable to remove the efficiency lower bound applicable to the DEAGP model to apply the remaining three methods. In the present case, pooled OLS is unsuitable as the sample includes the same private commercial banks for the entire period under observation (2014-2015 to 2020-2021). Thus, we will consider the fixed and random effects models for second-stage regression. We will conduct pooled OLS, fixed, and random effects models in the third analysis stage.

4.3 | Description of Input/Output and Contextual Variables

Estimating bank efficiency in the first stage of our study requires identifying inputs and outputs. However, since banking is a financial services provider industry, outputs/inputs can be defined in a number of ways. To be more specific, there are at least five approaches for choosing bank output/input: 1) production approach, 2) financial intermediation approach, 3) value-added approach, 4) risk mitigation approach, and 5) user cost approach. The user cost approach considers an item as an input or output of the insurance industry depending on whether the net revenue contribution of the item is negative or positive [57], [58]. In the present case we will follow this approach for selecting inputs/outputs. Thus, operating expenses are the two input indicators, and interest income and other income (from off-balance sheet and fee-based activities) are the output indicators.

For second-stage regression, contextual variables influencing bank efficiency are to be identified. In the present case, we will choose three important contextual variables: capital adequacy ratio, net nonperforming

asset ratio, and log of total assets (indicator of bank size). In the third and final stage, we will use ROA as the validation variable. *Table 1* provides an overview.

Table 1. Input/output, contextual, and validation variables.

Types of Variables	Indicators Chosen
Input	Operating expenses, interest expenses
Output	Interest income, other income
Contextual	Capital adequacy ratio, net NPA ratio, Log of total asset
Validation	ROA

*Source: the authors

4.4|Choice of the Sample Period

The estimates made in the present study are based on Indian PSCB data from 2014-2015 to 2020-2021. We have chosen this particular period for collecting data because of the onset of a recession in the Indian economy and the consequent adverse impact on the banking sector. The sample size is 18 (11 old PSCBs and 7 new PSCBs) for each year under observation. As mentioned earlier, the old PSCBs existed before the onset of economic and banking sector reform in India (July 1991), while the new ones were established after the announcement of the entry policy by the RBI in 1993. Only those PSCBs that existed for each sample year are considered. Data have been collected from RBI publications: report on Trend and Progress of Banking in India and statistical tables relating to banks in India.

5|Results of the 3-Stage Procedure

We review the steps monitored in our study as follows:

I. Run the DEAGP model under variable returns to measure the efficiency scores of banks for each year using *Model (4)*.

II. Regress the logarithm of efficiency scores on all contextual variables.

III. Evaluate the MA as the residual of the regression in the previous step.

IV. Run fixed effects and random effects regression on contextual variables.

V. Compare the previous step's models by employing the Hausman test.

VI. Run OLS regression of MA on category dummy.

VII. Run fixed effects and random effects regression of the return on the asset on the MA estimate.

VIII. Comparison between the previous step's models by using the Hausman test.

IX. Regress the efficiency change on the change in MA amongst sequential years.

The results and analysis are given in the following subsections. It should be noted that the data processing software for efficiency estimates is Lingo software.

5.1|Results of Stage One (Efficiency scores)

The first stage towards the estimation of MA of the Indian bankers is to calculate the technical efficiency for each year under observation. The technology is assumed to be local indicating the operation of variable returns to scale. *Table 2* provides the descriptive statistics of efficiency scores comprising mean, standard deviation, skewness and kurtosis for the years under observation (2014-2015 to 2020-2021). The range of efficiency scores is between 0 and 1. The table shows that mean efficiency varied between 0.977 (2016-2017) to 1 (2020-2021), while the standard deviation of efficiency fluctuated between 0.055 (2019-2020) and 0.087 (2020-2021). Except for 2020-2021, efficiency distribution exhibited negative skewness. Kurtosis was lowest in 2014-2015 and highest in 2018-2019. The bank-wise efficiency scores are included in Appendix, *Table A2*. A graphical presentation of the mean efficiency scores is provided in *Fig. 1*.

Table 2. Descriptive statistics of efficiency scores.

Descriptive Statistics	2014-2015	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021
Mean efficiency	0.98	0.99	0.977	0.99	0.99	0.98	1
Standard deviation	0.07	0.07	0.07	0.06	0.07	0.05	0.09
Skewness	-0.54	-0.56	-1.28	-0.34	-0.61	-0.01	0.35
Kurtosis	0.02	0.18	1.66	1.06	2.9	0.39	0.33

*Source: Calculated

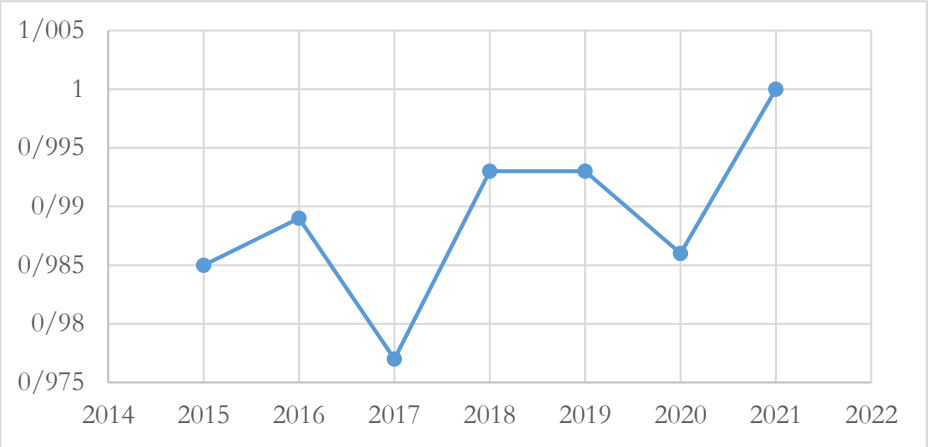

Fig. 1. Mean efficiency scores of PSCBs.

5.2 | Comparison of Efficiency across Bank Categories

Our first maintained hypothesis (H_1) posits that there is no difference in the efficiency performance between the old and new PSCBs. We compare the efficiency scores across the two categories of private-sector banks to test their validity. *Table 3* presents the mean efficiency scores of the two categories of PSCBs (old and new) for the observed years. The table also includes the relative mean efficiencies of old private banks in terms of new private banks. *Table 3* and *Fig. 2* clearly indicate that new private banks had higher mean efficiency for the entire period than the old private banks, and the gap was lowest in 2017-2018 and highest in 2020-2021. Thus the hypothesis H_1 is rejected.

Table 3. Mean efficiency comparison of old/new PSCBs.

Bank Category	2014-2015	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021
Old PSCBs	0.96	0.96	0.96	0.99	0.97	0.97	0.98
New PSCBs	1.02	1.03	1.0	1.0	1.02	1.01	1.08
Relative mean efficiency (old/private)	0.94	0.93	0.96	0.98	0.95	0.97	0.9

*Source: Calculated

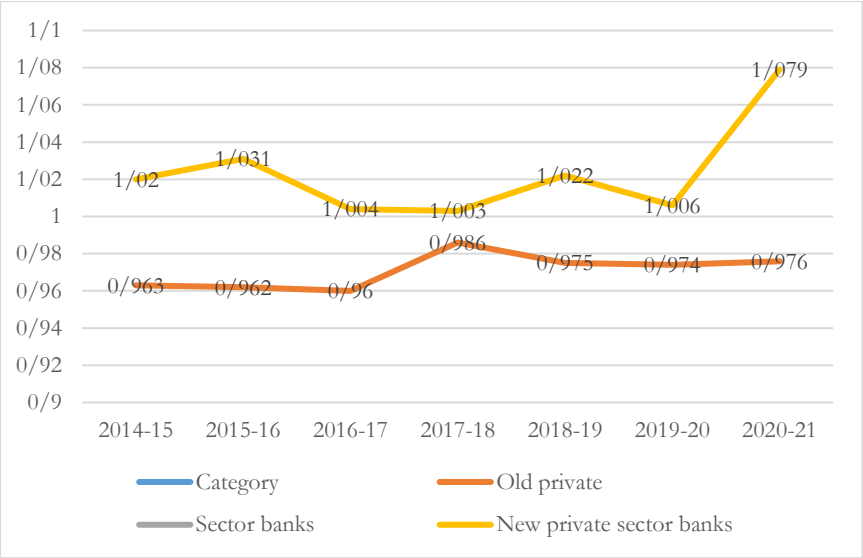

Fig. 2. Efficiency scores comparison of old/new PSCBs.

5.3 | Results of Stage Two

Company-specific and manager-specific factors influence the efficiency scores obtained from applying the DEAGP model in the first stage. First, the influence of company-specific factors should be eliminated to estimate the MA. Therefore, the efficiency scores are regressed on the following three contextual variables (except MA), including NPA Ratio, Capital-to-Risk weighted Assets Ratio (CRAR), and Log (total asset) using both fixed effects and random effects panel data models. Hausman test is run to decide between the models. In the case of the Hausman test, we test the null hypothesis that the GLS random effects estimators are consistent against the alternative hypothesis that they are not. If the p-value associated with the asymptotic Chi-square statistic is less than the critical value then we reject the null hypothesis and otherwise not. Thus, the regression model could be written as follows:

$$\text{Ln}\,(E_i) = \beta_0 + \beta_1(\text{NPA Ratio}) + \beta_2(\text{CRAR}) + \beta_3(\text{Log (Total Assets)}) + \epsilon_i. \quad (5)$$

Here $\text{Ln}(E_i)$ stands for logarithm of efficiency score of the i^{th} private bank, and Log (total assets) represents the logarithm of the total assets.

The results of the random effects model are included in *Table 4* and indicate that the coefficients of all three contextual variables are statistically significant. The fixed effects model results are included in *Table 4*, as well. Hausman test results are represented in *Table 5*.

Table 4. Regression of efficiency scores on contextual variables (random/fixed effects models) (second stage).

Random Effects Regression, Fixed Effects Regression				
Particulars	**Coefficient**	**Standard Error**	**t-Ratio**	**p-Value**
Intercept	−0.33,−0.32	0.03,0.06	−9.47,−5.49	<0.0001
NPA ratio	−0.01	0.003,0.004	−2.31,−1.67	0.02,0.11
CRAR	0.01	0.002,0.003	2.39,1.94	0.02,0.07
Log TA	0.02	0.004	5.79,5.03	<0.0001,0.0001
R squared	0.39			
Sum squared residual	0.38			
Standard error of regression	0.06			

*Source: Calculated

Table 5. Hausman test result (second stage).

Dependent Variable	Log of efficiency
Null Hypothesis (H_0)	Random effects model is preferable
Alternative Hypothesis	Fixed effects model is preferable
Chi-Square Statistics	1.4967
P-Value	0.6830

5.4 | Results of Stage Three (Estimates of MA)

Table 6 presents the descriptive statistics of MA estimates obtained as the regression residuals. The table shows mean ability is 0 for 2014-2015, negative for 2016-2017, 2018-2019, 2019-2020, and positive for the remaining 3 years under observation. A picture of the comparative movement in the MA scores estimated by eliminating the influence of the contextual variables on the efficiency scores from 2014-2015 till 2020-2021 is provided in *Fig. 3*. The bank-wise MA scores are provided in Appendix, *Table A2*.

Table 6. Descriptive statistics of MA estimates.

Descriptive Statistics	2014-2015	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021
Mean ability	0.00	0.07	-0.01	0.003	<-0.01	-0.01	0.01
Standard deviation	0.05	0.05	0.06	0.06	0.06	0.06	0.06
Skewness	0.35	0.27	-0.41	0.34	-0.64	0.35	0.11
Kurtosis	1.21	0.23	-0.09	-0.94	2.48	0.95	-0.79

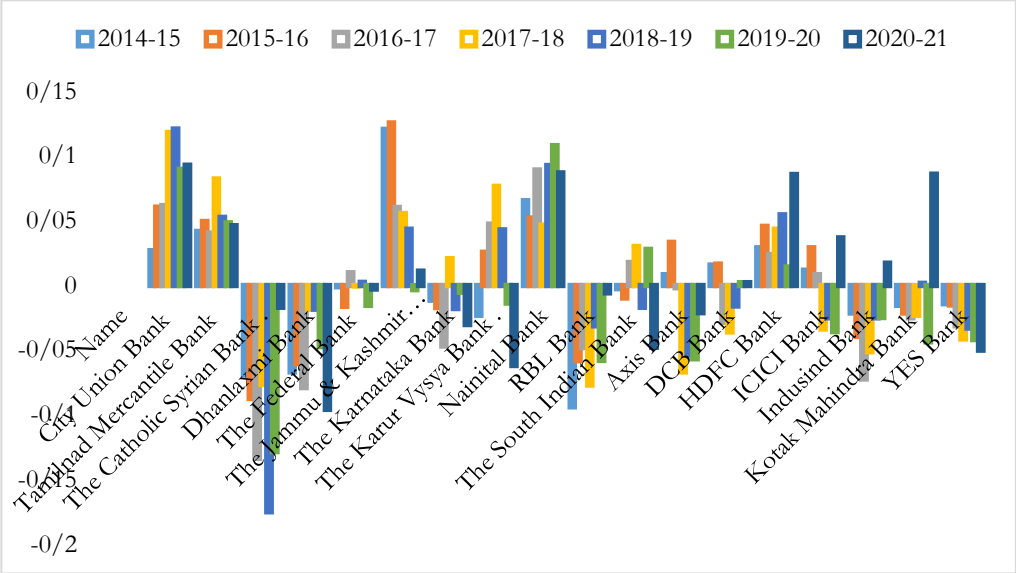

Fig. 3. Movements in mean MA during the observation period.

For testing our second hypothesis (H_2), we want to compare the MA of old and new PSCBs. Accordingly, the mean MA scores of the two groups of commercial banks are presented in *Table 7*. The table shows that the new PSCBs exhibited higher mean MA scores than the old PSCBs for 2014-2015, 2015-2016 and 2020-2021, while the reverse is true for 2016-2017 to 2019-2020. *Fig. 4* provides a graphical presentation. The mean MA of the old private sector banks for the observed period is higher than that for the new ones. Thus H_2 is also rejected.

Table 7. Comparison of mean MA.

Bank Category	2014-2015	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021	Mean of Observed Period
Old PSCBs	<-0.01	0.01	<0.01	0.02	0.01	<0.01	<-0.01	0.005
New PSCBs	<0.01	0.01	-0.02	-0.03	-0.01	-0.03	0.02	-0.008
Overall	0.00	0.01	-0.01	<0.01	<-0.01	-0.01	0.01	0.000

*Source: Calculated

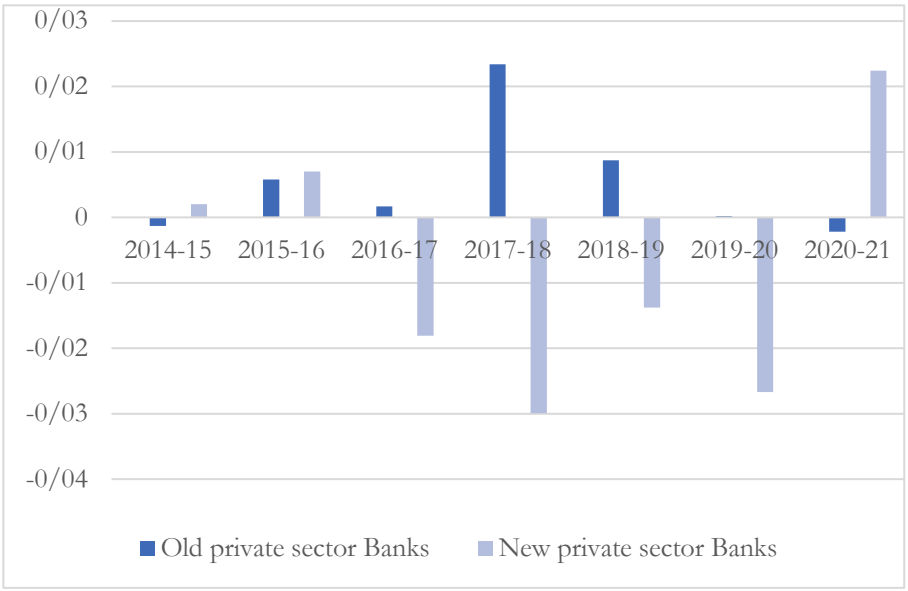

Fig. 4. Mean MA of old/new PSCBs.

In order to further establish the relationship between MA and bank category, we will also regress MA on bank category dummy (0 for old PSCBs and 1 for new PSCBs) to see whether there is any significant difference in MA across bank groups. The results of OLS regression are presented in *Table 8* and indicate that the coefficient of category dummy is negative but not statistically significant, and old PSCBs have done better.

Table 8. OLS regression of MA on category dummy (third stage).

Particulars	Coefficient	Std. Error	Observed t	p-value
Intercept	0.0052	0.0047	1.098	0.2877
Category Dummy	−0.0133	0.0085	−1.564	0.1361

*Source: Calculated

5.5 | Validation of MA

Finally, as a measure of validation for our estimate of MA, we have regressed ROA, a measure of bank profitability, on MA estimate and bank category dummy (0 for old PSCBs and 1 for new PSCBs) using panel data models. Once more, we compared the results obtained from the fixed effects and random effects model and selected the random effects model based on Hausman test results. The random and fixed effects regression outcomes are included in *Table 9*, respectively, and the results of the Hausman test are provided in *Table 10*. *Table 9* indicates that the coefficient of both the explanatory variables (MA and category dummy) are statistically significant. Specifically, on an overall basis, the new PSCBs have demonstrated higher MA than the old banks based on the data available for the period under observation.

Table 9. Regression of ROA on MA estimate (random/fixed effects models) (third stage).

Random Effects Regression, Fixed Effects Regression				
Particulars	**Coefficient**	**Standard Error**	**t-Ratio**	**p-Value**
Intercept	0.49, 0.52	0.16, 0.11	3.05, 4.82	0.002, 0.0002
MA	4.91, 5.38	1.798, 1.44	2.73, 3.73	0.006, 0.002
Bank category dummy	0.75, 0.68	0.26, 0.28	2.90, 2.44	0.004, 0.03
R squared	0.20, 0.28			
Sum squared residual	98.74, 88.6			
Standard error of regression	0. 89, 0. 91			

*Source: Calculated

Table 10. Hausman test result (third stage).

Dependent Variable	ROA
Null Hypothesis (H_0)	Random effects model is preferable.
Alternative Hypothesis	Fixed effects model is preferable.
Chi-Square Statistics	2.4040
P-Value	0.3006

For testing our third research hypothesis (H_3), we are interested to know whether there is a difference in the impact of MA on bank profitability across the old and new private sector banks. Therefore, we now regress the return on the asset on an interactive variable Category Dummy * MA. The coefficient of the interactive explanatory variable is significant at a 95% confidence level for the random effects panel data model and at 90% for the fixed effects panel data model. The random and fixed effects model results are presented in *Tables 11* and *12*, respectively. The Hausman test outcome (*Table 13*) favors the random effects panel data model marginally. The test results indicate that H_3 is not valid.

Table 11. Random effects regression of the ROA on the interactive variable.

Particulars	Coefficient	Standard Error	t-Ratio	p-Value
Intercept	0.7935	0.15	5.44	<0.0001
Category dummy*MA	3.7	1.79	2.06	0.0391
R squared	0.074			
Sum squared residual	114.29			
Standard error of regression	0.956			

*Source: Calculated

Table 12. Fixed effects regression ROA on the interactive variable.

Particulars	Coefficient	Standard Error	t-Ratio	p-Value
Intercept	0.7929	0.006	138.1	<0.0001
MA	3.51	1.811	1.94	0.0696
R squared	0.45			
Sum squared residual	67.82			
Standard error of regression	0.796			

*Source: Calculated

Table 13. Hausman test result.

Dependent Variable	ROA
Null Hypothesis (H_0)	Random effects model is preferable.
Alternative Hypothesis	Fixed effects model is preferable.
Chi-Square Statistics	0.0555
P-Value	0.8138

Further, we have tested the comparative efficiency and MA performance of old and new PSCBs and found that while the new private sector banks have performed better in efficiency, the reverse is true in the case of MA. A closer scrutiny reveals that in terms of average MA over the observed period, the first four ranks are occupied by the old PSCBs. Only one new PSCB (HDFC Bank) finds a place in the top five and only three banks (HDFC, ICICI, and Kotak Mahindra Banks) are included in the top ten.

However, as discussed earlier, the observed private-sector banks have done better in terms of mean efficiency for each observed year. This is actually due to a lower level of NPAs, which facilitated the attainment of better profitability, superior market presence and better capital adequacy position compared to the old PSCBs (*Table 14*). While the old banks need to focus on operating parameters, new banks must pay attention to MA, as managerial performance is crucial for long-run survival.

Table 14. Comparative performance of old and new private sector banks in terms of working parameters.

Category	Variable	2014-2015	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021
Old banks	NNPA Ratio	1.51	2.09	2.38	2.70	3.00	2.69	3.10
New Banks	NNPA Ratio	0.66	0.87	1.51	1.63	1.36	1.62	1.83
Old Banks	CRAR	13.29	12.58	12.84	13.67	14.44	15.32	16.44
New Banks	CRAR	15.63	15.97	16.00	16.84	16.39	15.91	19.12
Old Banks	ROA	0.67	0.50	0.49	0.52	0.47	0.29	0.67
New Banks	ROA	1.81	1.59	1.46	1.29	1.07	0.28	0.90

*Source: Calculated

6 | Conclusion

The theoretical and empirical literature on MA has considered and demonstrated MA as an important influencing factor of firm earnings performance. Because of the above, the present study proceeded with two specific objectives in mind: first, to provide a reasonable estimate of MA for Indian PSCBs and second, to see whether any category-wise differences in MA. Based on our 126 bank-year observations spread over seven financial years (2014-2015 to 2020-2021), we have derived estimates of MA for the in-sample 18 PSCBs and found that it significantly explains bank profitability performance (as a proxy for ROA). Further, the old PSCBs exhibited better MA performance considering the entire period.

The study shows that based on average MA over the observed period, old PSCBs have done better as the old PSCBs occupy the first four ranks. Only one new PSCB (HDFC Bank) finds a place in the top five and only three banks (HDFC, ICICI, and Kotak Mahindra Banks) are included in the top ten. However, these banks have done better in terms of efficiency due to low debt overhang, leading to better profitability, superior market presence and better capital adequacy position compared to the old PSCBs. While the old banks need to focus on operating parameters, new banks must pay attention to MA, as managerial performance is crucial for long-run survival.

The study, however, has two limitations. First, there are a limited number of Indian PSCBs operating in India. The public sector banks had experienced a series of mergers. Due to the presence of government control, there are obvious difficulties in comparing these banks with their private-sector counterparts. On the other hand, foreign banks have extremely limited geographic presence in India. Second, the period of study is seven years. Future studies can take care of these issues.

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Data Availability

The data supporting this study's findings are available from the corresponding author upon a reasonable request.

Conflicts of Interest

All co-authors have seen and agreed with the manuscript's contents, and there is no financial interest to report. We certify that the submission is original work and is not under review at any other publication.

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Appendix A

Table A1. Growth of private sector bank business (2014-2015 to 2020-2021).

Particulars	2015	2016	2017	2018	2019	2020	2021	CAGR
Deposits	1834470	2147673	2564839	3013688	3770013	4159043	4800648	14.73%
Advances	1584311	1939339	2219475	2662753	3327328	3625154	3939292	13.90%
Investments	668180	798530	855101	1011814	1222045	1293031	1512480	12.38%
Net worth	269131	329080	381979	443558	549009	608615	737096	15.48%
Net NPA	14128	26677	47780	64380	67309	55683	55809	21.68%

CAGR: Compound annual growth rate.

Table A2. Efficiency/MA performance of the observed commercial banks.

Year	2014-2015	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021
Bank Name	Efficiency/MA	Efficiency/MA	Efficiency/MA	Efficiency/MA	Efficiency/MA	Efficiency/MA	Efficiency/MA
City Union	1.005/0.0269	1.03/0.0604	1.0391/0.0618	1.105/0.1181	1.089/0.1209	1.0597/0.0898	1.0763/0.0929
Tamilnad Mercantile	1.010/0.0416	1.01/0.04942	1.0071/0.04057	1.0524/0.0823	1.029/0.0527	1.0346/0.0484	1.0334/0.0461
The Catholic Syrian	0.855/-0.0694	0.83/-0.0875	0.7986/-0.1336	0.840/-0.0766	0.807/-0.1749	0.8808/-0.1284	0.988/-0.0169
Dhanlaxmi	0.853/-0.0668	0.84/-0.0605	0.8473/-0.0791	0.9160/-0.0183	0.919/-0.0184	0.9037/-0.0474	0.8419/-0.0958
The Federal	0.999/-0.0011	0.97/-0.0161	0.9948/0.0099	0.999/-0.0002	1.003/0.0024	0.9909/-0.0155	1.0084/-0.0029
The Jammu & Kashmir	1.090/0.1206	1.07/0.1255	1.0010/0.0602	1.0018/0.0555	0.998/0.0435	0.9588/-0.0032	0.9835/0.01114
The Karnataka	0.952/-0.0115	0.94/-0.0171	0.9235/-0.0469	0.9804/0.0208	0.952/-0.018	0.9627/-0.0053	0.9499/-0.0304
The Karur Vysya	0.96/-0.0231	1.00/0.0256	1.0102/0.0473	1.0412/0.0767	1.010/0.0429	0.9692/-0.0137	0.9391/-0.062
Nainital	1.010/0.0655	0.99/0.0521	1.0177/0.0891	0.9901/0.0466	1.001/0.09266	1.0126/0.10794	0.9887/0.08688
RBL	0.87/-0.0938	0.91/-0.0583	0.9332/-0.0481	0.9192/-0.0771	0.957/-0.0313	0.9417/-0.0581	1.0008/-0.0057
The South Indian	0.968/-0.0025	0.94/-0.0098	0.9917/0.0178	0.9998/0.03016	0.949/-0.017	0.9998/0.02791	0.9279/-0.0479
Axis	1.047/0.0083	1.07/0.0332	1.0289/-0.0018	0.9669/-0.067	0.987/-0.0537	1.001/-0.0568	1.0542/-0.0211
DCB	0.975/0.0158	0.97/0.0166	0.9368/-0.0286	0.9499/-0.036	0.975/-0.016	0.9964/0.00209	1.0/0.00207
HDFC	1.088/0.0291	1.10/0.0458	1.0763/0.0240	1.1031/0.0434	1.135/0.0545	1.1049/0.0143	1.1917/0.0858
ICICI	1.061/0.0119	1.07/0.0292	1.03/0.0083	1.0058/-0.0337	1.026/-0.0252	1.0192/-0.0357	1.1212/0.0368
Indusind	0.968/-0.0214	0.97/-0.0394	0.9479/-0.0724	0.970/-0.0512	0.990/-0.0251	1.0002/-0.0249	1.0639/0.01733
Kotak Mahindra	0.999/-0.0154	1.00/-0.0214	0.9999/-0.0252	1.0177/-0.0231	1.04/0.00163	1.0037/-0.0437	1.1705/0.08604
YES	1.00/-0.0143	1.01/-0.0151	0.9987/-0.0312	1.006/-0.0414	0.998/-0.0329	0.9129/-0.0419	0.9512/-0.0501

Table A3. Efficiency-based ranking of the observed commercial banks.

Bank Name	2014-2015	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021
Axis Bank	4	3	4	14	12	7	6
City Union Bank	7	5	2	1	2	2	4
DCB Bank	11	11	14	15	13	10	10
Dhanlaxmi Bank	18	17	17	17	17	17	18
HDFC Bank	2	1	1	2	1	1	1
ICICI Bank	3	4	3	7	5	4	3
Indusind Bank	13	12	13	13	11	8	5
Kotak Mahindra Bank	10	8	9	5	3	6	2
Nainital Bank	6	10	5	11	8	5	11
RBL Bank	16	16	15	16	14	15	9
Tamilnad Mercantile Bank	5	6	7	3	4	3	7
The Catholic Syrian Bank.	17	18	18	18	18	18	12
The Federal Bank	9	13	11	10	7	11	8
The Jammu & Kashmir Bank	1	2	8	8	9	14	13
The Karnataka Bank	15	15	16	12	15	13	15
The Karur Vysya Bank .	14	9	6	4	6	12	16
The South Indian Bank	12	14	12	9	16	9	17
YES Bank	8	7	10	6	10	16	14

Table A4. Managerial ability performance of the observed commercial banks.

Bank Name	2014-2015	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021
City Union Bank	0.0269	0.0604	0.0618	0.1181	0.1209	0.0898	0.0929
Tamilnad Mercantile Bank	0.0416	0.04942	0.04057	0.0823	0.0527	0.0484	0.0461
The Catholic Syrian Bank	-0.0694	-0.0875	-0.1336	-0.0766	-0.1749	-0.1284	-0.0169
Dhanlaxmi Bank	-0.0668	-0.0605	-0.0791	-0.0183	-0.0184	-0.0474	-0.0958
The Federal Bank	-0.0011	-0.0161	0.0099	-0.0002	0.0024	-0.0155	-0.0029
The Jammu & Kashmir Bank	0.1206	0.1255	0.0602	0.0555	0.0435	-0.0032	0.01114
The Karnataka Bank	-0.0115	-0.0171	-0.0469	0.0208	-0.018	-0.0053	-0.0304
The Karur Vysya Bank .	-0.0231	0.0256	0.0473	0.0767	0.0429	-0.0137	-0.062
Nainital Bank	0.0655	0.0521	0.0891	0.0466	0.09266	0.10794	0.08688
RBL Bank	-0.0938	-0.0583	-0.0481	-0.0771	-0.0313	-0.0581	-0.0057
The South Indian Bank	-0.0025	-0.0098	0.0178	0.03016	-0.017	0.02791	-0.0479
Axis Bank	0.0083	0.0332	-0.0018	-0.067	-0.0537	-0.0568	-0.0211
DCB Bank	0.0158	0.0166	-0.0286	-0.036	-0.016	0.00209	0.00207
HDFC Bank	0.0291	0.0458	0.0240	0.0434	0.0545	0.0143	0.0858
ICICI Bank	0.0119	0.0292	0.0083	-0.0337	-0.0252	-0.0357	0.0368
Indusind Bank	-0.0214	-0.0394	-0.0724	-0.0512	-0.0251	-0.0249	0.01733
Kotak Mahindra Bank	-0.0154	-0.0214	-0.0252	-0.0231	0.00163	-0.0437	0.08604
YES Bank	-0.0143	-0.0151	-0.0312	-0.0414	-0.0329	-0.0419	-0.0501

Table A5. Managerial ability-based ranking of the observed commercial banks.

Bank Name	2014-2015	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021
Axis Bank	8	6	10	16	17	16	13
City Union Bank	5	2	2	1	1	2	1
DCB Bank	6	9	12	13	9	6	9
Dhanlaxmi Bank	16	17	17	10	12	15	18
HDFC Bank	4	5	6	6	3	5	4
ICICI Bank	7	7	9	12	14	12	6
Indusind Bank	14	15	16	15	13	11	7
Kotak Mahindra Bank	13	14	11	11	8	14	3
Nainital Bank	2	3	1	5	2	1	2
RBL Bank	18	16	15	18	15	17	11
Tamilnad Mercantile Bank	3	4	5	2	4	3	5
The Catholic Syrian Bank.	17	18	18	17	18	18	12
The Federal Bank	9	12	8	9	7	10	10
The Jammu & Kashmir Bank	1	1	3	4	5	7	8
The Karnataka Bank	11	13	14	8	11	8	14
The Karur Vysya Bank .	15	8	4	3	6	9	17
The South Indian Bank	10	10	7	7	10	4	15
YES Bank	12	11	13	14	16	13	16